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in Relation to Botany' (*Scientific Monthly*), and as Henry Jones Ford uses it in 'Radicalism in American Politics' (July, *Yale Review*), in the first paragraph of which he refers to Madison and Franklin as radicals. The word can not possibly be regarded as synonymous with, or identified with, Bolshevism, I.W.W., or anarchy." Ed.]

#### ANATOMICAL LITERATURE

PROFESSOR ERICH KALLIUS (Anatomisches Institute, Breslau, Germany), who has taken over the editorship of the *Anatomische Hefte* and *Ergebnisse der Anatomie und Entwicklungsgeschichte*, writes that it is difficult now to obtain foreign literature and that he would be very glad if American contributors would send reprints as freely as possible for the use of these journals.

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#### SCIENTIFIC BOOKS

*Greek Science and Modern Science. A Comparison and a Contrast.* By CHARLES SINGER. London, Oxford University Press, 1920, 80, 22 pp.

This lecture, inaugurating a systematic course on the history of science and of scientific ideas, was delivered at University College, London, on May 12, 1920. Its author, one of Emerson's "monks of Oxford," was a captain in the Royal Army Medical Corps during the recent war. Its object is to bridge over the embarrassing gap between the history of Greek science and that of modern science. It is a commonplace to deride the Middle Ages for sterility in science; the thing is to ascertain just how, where and why they were sterile. This department of historical investigation Singer defines as "the pathology and embryology of human thought"; for, in the Middle Ages, Greek science did slowly and surely die, and strange as it may seem, our modern scientific methods were actually engendered, by lengthy and painful travail, out of medieval restrictions.

Of this view of things, Dr. Singer's lecture gives a clear and intelligible account. The

argument is as follows: It is one of the vainest delusions of the modern mind to imagine that we can entirely enter into the modes of thought of the ancient Greeks. This fact, which Singer has frequently insisted upon in private correspondence, was already emphasized long ago in the verses of one who was very close to them, the Roman Lucretius.

Nec me animi fallit Graiorum obscura reperta  
Difficile inlustrare Latinis versibus esse,  
Multa novis verbis præsertim cum sit agendum  
Propter egestatem linguæ et rerum novitatem.

But it is at least reasonably certain that the Greeks based their scientific system upon Egyptian, Minoan and Assyro-Babylonian tradition, that this pre-Hellenic material was an anonymous, socialistic, collectivistic product; while the Greeks thought as individuals, not as a people, stamping their work, each one of them, with his own individuality, thus giving to science the eponymous character which it has since retained. We have only to think of Diophantine algebra, Euclidian geometry, the *corpus Hippocraticum* of Galenical remedies. Credulous and facile of generalization as were the Greeks, they had yet an abiding intuitive conviction that "order reigns in nature"; that behind the observed and observable phenomena there is an ascertainable law which correlates them and is their *raison d'être*. It is just this sense of law in nature and of the necessity for personal scientific investigation that is their most valuable heritage to posterity. This is what Sir Henry Maine meant when he said that "Nothing moves in the modern world which is not Greek." In the Middle Ages, the reckless freedom in speculation as to the causes of things which the Greeks enjoyed was suppressed by prince and prelate as subversive of the feudal theory of the state and of the theological view of the universe. But, in spite of the harm it has done, there was, in Singer's view, a distinct advantage in all this. It got the practical scientific worker away from sterile speculation and down to brass tacks; so that gunpowder, printing, the mariner's compass, spectacle lenses were immediately taken up, and the outcast, outlawed medieval

surgeon was forced to become a more practical bedside man than the top-heavy scholastic internist. The Levitical code of sanitation (isolation of suspects in eight contagious diseases), and Hindu (non Roman) surgery also gained a status. Modern science differs from Greek and medieval science, however, not so much in aims or results, as in processes and methods; and here we have "certain new factors of an order the world has not before seen." Except in the mathematics, the essence of which is to give steps and processes, the Greek scientist gave only conclusions and concealed his proofs, his findings being in the Lucretian phrase "*obscura reperta*." Concerning this, Singer says (p. 20):

Ancient mathematics, like everything else that has come down to us from antiquity, have of course suffered from the accidents of time, but the obscuring power of time is a mere light veil compared to that heavy impenetrable curtain that the Greeks have themselves drawn over their biological works.

The medieval scientists (witness the alchemists or Leonardo's mirror-written physiology) had the same tendency. But we pride ourselves upon the fact that our scientific monographs are devoted mainly to definite proofs of the author's propositions. The Greeks had no instruments of precision because, being speculative philosophers, they felt no necessity for proofs. Thus, while mathematics, however interrupted by the Dark Ages, is a scientific continuum, medieval science, like Greek science, is too frequently a solution of continuity, while the continuity of modern science is insured by simple preservation of records. The only danger threatening modern science, as Singer sees it, is in the isolation of scientific workers through the extreme and complex specialization of their subjects, making one branch of science unintelligible to the followers of another. The best way to obviate this danger is through the broad study of the historical evolution of science as such, for this "experimental" method will evade the pitfalls which befell Whewell and Comte, viz., the arbitrary concept of a rigid orthodoxy in science, based upon a quasi-medieval hierarchy

of all the sciences. The history of science is not secular or sociological history, but the cultural history of mankind, the bases of which are anthropology and psychology. Through this branch of study we may clarify our own concepts, document and preserve our records, correlate our findings and so establish a continuum with the future and the past.

The finely wrought argument (Singer at his best) concludes with the thought, familiar to us in certain well-known verses of Lucretius, that the distinctive hope and glory of the science of our age is "that it will place in the hands of the inheritors of our civilization and our thought, whoever they may be, an instrument that will enable them to carry on our work from the point at which we leave it." No one can read this inspiring lecture without a heightened, clarified perception of the superior worth of modern science and the dangers which beset it. In the lecturer's own words:

Our scientific system, of its nature, claims an independence of all race, nationality or creed. It is of all studies the most truly international. The scientific man may, better than most, claim with St. Paul that he is a citizen of no mean city, that he is the true citizen of the world.

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### SPECIAL ARTICLES

#### THE PRODUCTION OF ARTIFICIAL HERMAPHRODITES IN MAMMALS

DURING the last ten years especially, there has been a decided impetus towards the analysis of sexual conditions, in animals, that has largely centered itself around a study of the physiology of the sex glands by means of transplantation experiments. From 1910 to 1913 Steinach reported his remarkable results obtained from sex gland transplantation in which one sex gland had been transferred to young castrated animals of the opposite sex (rats and guinea-pigs). The results in brief were: (a) masculinization of female animals by implanted testes (*i. e.*, the young female animal, after receiving the transplant, developed into a male-like animal as indicated